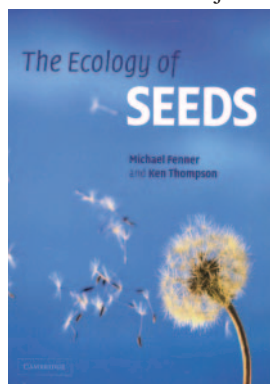


Book Reviews

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The ecology of seeds.

Fenner M, Thompson K. 2005. Cambridge: Cambridge University Press. £26 (softback) £55 (hardback) 260 pp.

This volume is a timely update and considerable expansion of the small book *Seed Ecology*, published by the first author twenty years ago, and long out of print.

Is it useful to separate a particular branch of study such as ‘seed ecology’ from the wider field of plant ecology? Aren’t seeds just a particular packaged form of the sporophyte, at a certain stage in its life cycle? While some may ask those questions, a major strength of this book is the care that the authors take throughout to set their review in the context of current ecological thinking and debate. They achieve this is by the (chrono)logical progression of their chapters, and also by the provision of boxed discussions of a number of ‘hot’ topics and questions at appropriate points in the text.

The first chapter sets the scene by considering general questions of life histories, reproductive strategies and allocation. The issue of sexual versus asexual reproduction in plants leads to all the topics around resource allocation and the costs of seed production, giving special emphasis to the question of seed size and its variation, and a useful boxed discussion of ‘trade-off’. Perhaps surprisingly, the authors haven’t included the classic review on seed size and shape by Harper *et al.* (1970). However, they do remind readers of the often large variation in seed crops between years in many species, a feature often forgotten or ignored, but long known and measured (mast fruiting), especially by foresters (e.g. Schwappach, 1895).

Chapter 2 discusses hazards during seeds’ development, including poor pollination, resource limitation and pre-dispersal predation. The boxed discussion features low seed set in sparse populations (the Allee effect), an understanding of which has important consequences for potential extinction and conservation efforts to counteract it.

The authors point out in Chapter 3 that probably few things in seed ecology have changed more in recent years than our understanding of the fascinating topic of seed dispersal. For example, for both wind- and animal-dispersed seeds there has been an underestimate of the importance of the ‘tails’ of distributions of dispersal distance; and the numbers of seeds achieving such extreme dispersal distances are mostly underestimated because of methodological problems. The boxed essay highlights how little we know

about why the fleshy fruits of some plants, presumed to attract animal dispersers, are nevertheless poisonous.

Chapter 4 covers a particular specialism of the second author: soil seed banks, their composition, dynamics and ecological significance; with a brief mention of aerial seed banks (serotiny). The now well-known classification of seed bank types is described; along with caveats on methodology, and a boxed consideration of seed persistence as a plant trait—the conclusion being that it is mainly a species trait, but one that can be modified by environmental conditions.

Chapters 5 and 6 respectively consider seed dormancy and seed germination. One link between Chapters 4 and 5 is that seed dormancy and persistence in soil are not necessarily related, perhaps counter-intuitively. Dormancy is one, though not the only means by which germination is delayed following shedding, so that it takes place at the right time and in the right place. The authors give a clear and commonsense account of the various attempts to describe and classify seed dormancy, which from time to time have descended into semantics; and this will be especially valuable for the novice. Does light break dormancy, or is it merely an environmental cue for germination? The authors favour the latter, but give fair exposure to the former view. Topics overlap between these two chapters; and, for example, some of the apparent confusion around the role of temperature is explained by the fact that exposure to particular temperature regimes can act both to remove dormancy and provide an environmental cue for germination (radicle growth). Seed germination in response to smoke has been of special interest in the last few years, and this is covered in the boxed essay in Chapter 6.

Post-dispersal hazards such as predation, loss to pathogens, fatal germination at depth and loss of viability due to ageing are all covered in Chapter 7. To round off and return to the broad ecological and evolutionary context of the first, the final two chapters cover the related topics of seedling establishment (Chapter 8) and ‘gaps, regeneration and diversity’ (Chapter 9), making the link to adult plants and their distribution and abundance—the stuff of plant ecology. A thoughtful and useful boxed essay in Chapter 9 considers whether seed traits are linked to the abundance of species; and concludes that they are not in any consistent way, having shown in Chapter 1 that seed traits and adult plant traits are not strongly associated, with the latter perhaps mostly determining species range.

Overall, the authors have been very successful in achieving their aim ‘to synthesise the current information available on the ecological aspects of seed biology’. While their review of the current literature is a broadly representative overview, rather than comprehensive, this volume cites well over three times as many papers as its predecessor; pointing

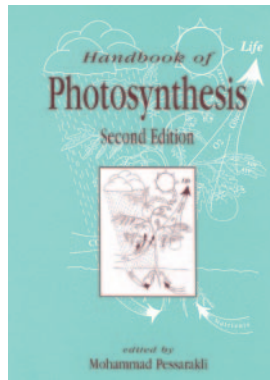
to the substantial increase in interest and activity in the subject over the last twenty years. For depth of coverage it cannot compete with the relatively recent collection of reviews by individual specialists edited by the first author (Fenner, 2000). Nevertheless, its coverage of the very recent literature has to give it some advantage. As an introduction to seed ecology, complementary to that earlier volume, it is excellent. The consistency of style, compared with multi-author compilations, will help it appeal to a broad range of readers; from schoolteachers and keen pupils seeking low-cost but relevant ecological projects, to ecologists and botanists requiring an accessible, rapid introduction to the subject. The style is clear and rigorous and at the same time engaging—a good read! The reviewer's copy was a soft-back version, well produced and attractive for its reasonable price, putting it in easy range of most students.

John Dickie

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Handbook of photosynthesis, 2nd edition.

Pessarakli M. (ed). 2005. Boca Raton: CRC Press. \$159.95 (hardback). 928 pp.

The motto of the Photosynthesis Congress in Brisbane in 2001 was that 'photosynthesis simply sustains all life on Earth'. For this reason, photosynthesis is a large, well-researched area, so it is especially ambitious to put

together a handbook that attempts to cover the whole subject. This volume is definitely not a handbook in the sense that it provides a compendium for the novice, but instead it is a conspectus of areas of current research interest.

There is a broad coverage of the subject area, with a fair degree of prominence given to crop productivity and stress. The book comprises 46 chapters organized into 14 sections. These sections range from the biochemistry of photosynthesis, including topics as diverse as chlorophyll biosynthesis, chloroplast biogenesis and the role of phosphorus in photosynthetic carbon metabolism. Then there are sections on molecular aspects of photosynthesis (seven chapters), photosynthesis and the environment (five chapters), photosynthetic pathways in crop plants (two chapters), photosynthesis in different parts of the plant (one chapter), crop productivity and photosynthate formation (two chapters), measurement of pigments and photosynthetic

activity (three chapters), and a large section on photosynthesis and stress, mainly drought and salt stress (nine chapters). I found the sections rather contrived and would rather have seen fewer of them. There are good chapters on a spectrum of topics ranging from chlorophyll biosynthesis, aspects of photosystems 1 and 2, multi-enzyme complexes, photoinhibition and energy dissipation, regulation of photosynthesis during leaf development, photosynthate partitioning, to effects of stress on photosynthesis. Then there are topics which make one think anew about an area, such as the role of cytochrome c_6 in photosynthesis, the origins of the mid-day depression of photosynthesis, and the potential for improvement of radiation use efficiency in crops.

The chapters are quite variable in length, content and degree of referencing. Some chapters are rather parochial in content, and thus very specialist, while others seek to cover large areas, sometimes in too brief a manner. Some offer a very personal perspective. The handbook is thus very much a curate's egg (good in parts!). These points are amply illustrated by considering the coverage of C_4 photosynthesis. Chapter 46 (Origin and Evolution of C_4 Photosynthesis) initially excited my interest, until I found that it is only eight pages long and barely does justice to either topic. There is a useful discussion of past changes in the composition of the atmosphere, but beyond that I don't think that either the novice or the expert would be much the wiser. Then there is a general chapter on C_3 , C_4 and CAM, which one would hope might be useful to students. In practice, it neither serves as a good general introduction (there is only one diagram, for example), nor is it up-to-date (for example, C_4 photosynthesis occurs in 19, not 10, plant families) or detailed enough for researchers in the area. In stark contrast, there is an excellent chapter (Chapter 22, Photosynthesis in Nontypical [*sic*] C_4 Species) that is a well-illustrated and well-referenced account covering a great deal of recent research into single-celled C_4 systems. There is also a good short review of the consequences of rising atmospheric CO_2 on C_4 photosynthesis. But why weren't these four chapters placed together in one section?

Chapters in another section (Photosynthetic Activity Measurement and Analysis of Photosynthetic Pigments) are of similarly disparate quality. An excellent and thoughtful chapter on the relationship between CO_2 assimilation and growth is followed by a couple that are fairly baffling. One (Approaches to Measuring Plant Photosynthetic Activity) concentrates on excessively detailed methods and recent research results rather than on the bigger picture, while another chapter (Analysis of Photosynthetic Pigments) is excessively general and does not give any real clues as to the problems encountered in, for example, chlorophyll extraction and assay, or direct the reader to any clearly recommended methods. In my view a handbook should contain precisely such information.

The book is well produced, and the double-column format is easy on the eye. The figures are generally clear and well reproduced, although I would have welcomed more of them. Despite the fact that it is not suited to undergraduates, I did find material that will be useful for teaching.